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REPORT OF SURVEY CONDUCTED AT

**HEADQUARTERS, U.S. ARMY
INDUSTRIAL OPERATIONS COMMAND
ROCK ISLAND, IL**

FEBRUARY 1997

Best Manufacturing Practices



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**BEST MANUFACTURING PRACTICES CENTER OF EXCELLENCE
College Park, Maryland
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Foreword



This report was produced by the Best Manufacturing Practices (BMP) program, a unique industry and government cooperative technology transfer effort that improves the competitiveness of America's industrial base both here and abroad. Our main goal at BMP is to increase the quality, reliability, and maintainability of goods produced by American firms. The primary objective toward this goal is simple: to identify best practices, document them, and then encourage industry and government to share information about them.

The BMP program set out in 1985 to help businesses by identifying, researching, and promoting exceptional manufacturing practices, methods, and procedures in design, test, production, facilities, logistics, and management – all areas which are highlighted in the Department of Defense's 4245-7.M, *Transition from Development to Production* manual. By fostering the sharing of information across industry lines, BMP has become a resource in helping companies identify their weak areas and examine how other companies have improved similar situations. This sharing of ideas allows companies to learn from others' attempts and to avoid costly and time-consuming duplication.

BMP identifies and documents best practices by conducting in-depth, voluntary surveys such as this one at the Headquarters of the U.S. Army Industrial Operations Command, Rock Island, Illinois conducted during the week of February 24, 1997. Teams of BMP experts work hand-in-hand on-site with the company to examine existing practices, uncover best practices, and identify areas for even better practices.

The final survey report, which details the findings, is distributed electronically and in hard copy to thousands of representatives from government, industry, and academia throughout the U.S. and Canada – *so the knowledge can be shared*. BMP also distributes this information through several interactive services which include CD-ROMs, BMPnet, and a World Wide Web Home Page located on the Internet at <http://www.bmpcoe.org>. The actual exchange of detailed data is between companies at their discretion.

The Headquarters of the U.S. Army Industrial Operations Command represents the first of the Army depot and arsenal surveys to be conducted through the BMP program. As the largest major subordinate facility of the Army Materiel Command, the Industrial Operations Command manufactures, delivers, and supports materiel throughout the world for American service members, and performs total life cycle support worldwide. In addition, the Industrial Operations Command provides the highest quality and most advanced weaponry that American ingenuity and technology can produce.

The Best Manufacturing Practices program is committed to strengthening the U.S. industrial base. Survey findings in reports such as this one on the Headquarters of the U.S. Army Industrial Operations Command expand BMP's contribution toward its goal of a stronger, more competitive, globally-minded, and environmentally-conscious American industrial program.

I encourage your participation and use of this unique resource.

A handwritten signature in cursive script, reading "Ernie Renner".

Ernie Renner

Director, Best Manufacturing Practices

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Section 1

Report Summary

Background

The Headquarters of the U.S. Army Industrial Operations Command (IOC), located at the Rock Island Arsenal, Rock Island, Illinois is the largest major subordinate command of the Army Materiel Command (AMC). The IOC is a worldwide organization with installations and activities in 25 states and overseas. The IOC's viable industrial infrastructure is second to none in producing quality munitions and large caliber weapons as well as providing a full range of maintenance service for modern weapons. The IOC manufactures, delivers, and supports materiel throughout the world for America's service members.

The IOC provides the highest quality and most advanced weaponry that American ingenuity and technology can produce. Ensuring troops have the best materiel and services, the IOC performs total life cycle support worldwide. The IOC's facilities and highly skilled and mobile workforce can quickly and cost-effectively produce and test new weapons and ammunition products, ship materiel, sustain equipment, support materiel deployed worldwide, and demilitarize products. The IOC continually evaluates and improves its capabilities to serve customer needs.

The IOC is a flexible, responsive, and highly capable organization, performing a vital defense role through its expertise in the areas of maintenance, logistics and manufacturing; production base support; maintenance, repairs, and overhauls of today's sophisticated weapon systems and munitions; production of tomorrow's high technology systems; fabrication of hard-to-procure items; life cycle management of conventional ammunition; and maintenance of the Army's war reserve and operational project stocks required for power projection.

The IOC consists of 12 depots and activities, three arsenals, 21 ammunition plants, and a variety of other facilities. The IOC owns 39,307 buildings; 108.8 million square feet of floor space; 5,968 miles of roadways; and 2,171 miles of railroad track. Total employment is nearly 25,000 Department of Defense civilians, 400 military personnel, and 11,000 contractor employees. The BMP survey team considers the following practices to be among the best in government and industry.

Best Practices

The following best practices were documented at the Headquarters, U.S. Army Industrial Operations Command:

Item	Page
Low-Level Radioactive Waste	5
The IOC is designated as the Executive Agency for Low Level Radioactive Waste, servicing 143 sites. The IOC program avoids duplication of efforts, provides one voice to regulatory agencies, and diminishes violations and penalties.	
Pollution Prevention Centers for Technical Exchange	6
The IOC Environmental Compliance and Pollution Prevention Division coordinates and oversees the activities of teams of experts, referred to as Pollution Prevention Centers for Technical Exchange, in various process areas that represent the users of pollution prevention technology throughout the IOC.	
Single Process Initiative	7
The IOC implemented the Single Process Initiative to allow contractors to adopt common processes or commercial practices that meet the customer's requirements on a facility-wide basis.	
Armament Retooling and Manufacturing Support	7
The IOC adopted the Armament Retooling and Manufacturing Support program to allow commercial industry to use underutilized Army facilities until such time as they are again needed to support the mission of the Army.	
Ammunition Surveillance Information System	8
The IOC has created an electronic library used by Ammunition Quality Assurance Inspectors in the field. The system utilizes portable laptop computers, Compact Disc media, and electronic mail.	

Item	Page
Inventory Accountability - Ammunition	9

The IOC has developed an Inventory Accountability program that employs a 100% physical inventory, enhances the use of technology, reduces staff requirements, and reduces paper records.

Reduced Property Administration	10
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The IOC reduced property administration, for items valued at \$1,500 or less, by eliminating tracking and location control requirements, and also eliminating periodic physical inventories.

Alternate Disputes Resolution	10
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The IOC has developed an effective methodology for resolving disagreements with prime contractors before they become adversarial issues and formal contract disputes.

Leadership Development Strategy	11
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The IOC utilizes questionnaires allowing personnel to provide constructive input that enhances management leadership skills.

Team Building Strategy	12
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The IOC is implementing Team Building Strategy to improve operational effectiveness and customer satisfaction. Self-managed teams bring together cross-functional experts into one team. Benchmarking and intensive team training are utilized to assure success.

Information

The following information items were documented at the Headquarters, U.S. Army Industrial Operations Command:

Item	Page
Acquisition Tracking Center Streamlining	13

The IOC is implementing a plan to streamline and automate the existing acquisition process for major Conventional Ammunition Working Capital Fund and Production Base Support procurement programs.

Asset Stratification	13
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The new stratification process allows all U.S. military services to review Army assets in excess, economic retention, and contingency stock for potential cross leveling.

Item	Page
Ammunition Business Process Re-Engineering	14

The IOC is in the process of implementing a computerized manufacturing resource planning system to reduce delivery lead time.

Business Forecasting, Receipt and Issue	14
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The IOC has developed a new procedure for forecasting ammunition shipping and receiving, based on plans and estimates from worldwide military theaters. The forecast is designed to provide depots and arsenals an effective means of developing cost rates, manpower estimates, and storage space requirements.

Command Wide Presidential Quality Award Strategy	15
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The IOC has adopted a strategy to utilize internal Presidential Quality Award assessments for identifying organizational strengths and needed improvements.

Customer Satisfaction Measurement	15
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The IOC utilizes a customer satisfaction questionnaire for major customer groups. Data obtained will provide a basis for improving customer satisfaction through improved business processes.

Electronic Travel Order System	16
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The IOC has significantly reduced preparation labor and improved processing time for preparation of travel orders with the implementation of an Electronic Travel Order System. The system is PC-based and utilizes commercial software.

Enterprise Information System	16
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The Enterprise Information System is utilized throughout the IOC to deliver business information. The system provides management information while reducing paper reports, meetings, and briefings. The system is fielded to 21 IOC installations.

Labor Relations	17
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Labor and Management Partnership Councils are encouraged and utilized at the IOC installations to achieve a significant improvement in labor relations.

Item	Page	<i>Point Of Contact</i>
Out-placement Tools Through an aggressive out-placement program, the IOC has minimized involuntary separations while maintaining a flexible, responsive, and highly organizational capability.	17	For further information on items in this report, please contact: Ms. Kim Leight Logistics Management Specialist Ammunition Depot Branch AMSIO-AML Rock Island, Illinois 61299-6000 Phone: Commercial (309) 782-5093, DSN 793-5093 Fax: Commercial (309) 782-6422, DSN 793-6422 E-mail: KLEIGHT@ria-emh2.army.mil
Partnering Strategy The IOC has developed a partnering strategy with contractors that nearly eliminates undesirable adversarial relationships. The strategy was initiated through team building and planning activities at the senior level of the organizations.	18	
Procurement Action Management System The Procurement Action Management System automatically tracks each procurement action from receipt of a certified Procurement Work Directive with any associated technical data until the issuance of a contract.	18	
Staffing Analysis Staffing Analysis is used to measure time and manpower requirements to accomplish established missions and can also be used to evaluate contractor efficiency. The new process will establish workload and manpower on spread sheets based on a five-year history.	19	

Section 2

Best Practices

Production

Low-Level Radioactive Waste

The Army IOC is the designated Executive Agency for managing the disposal, control, guidance, records, and reporting of the Department of Defense (DoD) Low-Level Radioactive Waste (LLRW). This function came about through the aggressive and innovative approaches implemented by the Command's Radioactive Waste Disposal Division.

Low-Level Radioactive Waste requires compliance with stringent state and federal environmental regulations for safe disposal. Examples of LLRW managed by the IOC are gauges, medical waste, night vision devices, chemical detection instruments, engine components, missile components, laboratory waste, wrist watches, compasses, contaminated soils, exit signs, and smoke detectors. DoD LLRW represents 10% of the radioactive waste produced in the U.S. During the 1980s, DoD installations were cited for numerous incidents, accidents, and violations. DoD developed a reputation with regulators for having less than adequate practices and a large safety concern. In 1990, Congress tasked the General Accounting Office (GAO) to investigate the way the DoD managed waste, specifically LLRW. The GAO recommended the establishment of the DoD LLRW program to oversee the development of uniform policies and procedures; ensure compliance throughout DoD; and gain efficiencies of scale. Additionally, the GAO recommended developing one DoD-wide inventory, establishing consistent treatment techniques; working with State, compacts, and Federal regulators; and establishing outside continental United States (OCONUS) LLRW disposal.

In September 1992, the Army was designated as the Executive Agent for LLRW. The Radioactive Waste Disposal Division of the Army's IOC was designed to implement an aggressive disposal program, following the GAO recommendations, through implementation of the following innovative practices:

- Consolidation of Facilities: Established treatment centers for combining shipments, sorting and separating materials, reducing

volume, and ensuring quality shipments to disposal sites. This practice lowers customer costs, avoids violations at disposal sites, and improves relations with States and compacts.

- Use of Disposal Basic Ordering Agreements (BOAs): BOAs were established to avoid multiple contracts by combining all government disposal contracts.
- 8A Contracting: BOAs were established with small disadvantaged businesses. Ease and flexibility of BOAs with 8As allowed hand picking reliable contractors; ensured contractor capability/qualifications; and developed long-term relationships. 8A contractors have been ideal for small efforts and emergency responses, saving cost and delays in competitive bidding.
- Qualified Bidders List (QBL): A QBL was established to solicit only pre-qualified contractors for performing decontamination and disposal, shipping, and treatment technologies. This practice limits competitive bidding to only pre-qualified contractors, thus shortening contracting lead-time and avoiding delays caused by unqualified contractors.
- Combined Shipments: The practice of sweeping a geographical area to pick up waste at several installations resulted in reduced transportation, temporary duty, and contractor costs.
- IOC Staff vs. Contractor: IOC staff is used in place of contractors on selected LLRW collections to stabilize the IOC workforce, provide savings to its customers, as well as provide oversight requirements for some collections. IOC also takes advantage of military vehicles for transportation through proper planning and coordination. Savings in 1996 for this practice exceeded \$250,000.
- Permit Initiatives: IOC negotiated the State and Interstate permits required for importing and exporting LLRW for the entire DoD, rather than the multiple permits that would be required if all installations applied individually. Each permit avoided saved an average of \$500 per permit.
- Waivers and Deviations: Waivers and deviations were requested from State Regulators to get a better deal for large disposal efforts. Examples

included waivers and deviations for Mag-Thor Engines and Mag-Thor Missile scrap resulting in a combined cost avoidance of more than \$1.7 million.

- **Support For Other Government Agencies:** IOC provides a choice for other government agencies that do not have the expertise and the contracts in place to dispose of LLRW. Customers include United States Department of Agriculture, Veterans Administration, Federal Emergency Management Agency, National Aeronautics and Space Administration, United States Customs, Department of Justice, Environmental Protection Agency, Department of Energy, and the U.S. Geological Survey.

The Radioactive Waste Disposal Division, with a staff of 20 employees, currently services 143 sites annually. Their program avoids duplication of efforts; provides one voice to the regulators; increases responsiveness for LLRW disposal; lowers cost; and eliminates many violations and penalties. GAO recommendations have been exceeded. Customer satisfaction surveys rate the Division's overall performance at 3.8 on a scale of zero to four.

Pollution Prevention Centers for Technical Exchange

IOC's principal tool for compliance with the federal Pollution Prevention Act is the Pollution Prevention Centers for Technical Exchange (P2-CTX). P2-CTX coordinates and oversees the activities of teams of experts in various process areas that represent the users of pollution prevention technology throughout IOC. There are currently 18 different centers. Below is a list of the primary and back-up centers by category and installation:

CTX Assignments:

<i>P2 Category</i>	<i>Installation</i>
Chemical Depainting	Letterkenny Army Depot
Mechanical Depainting	Anniston Army Depot
Painting	Tobyhanna Army Depot
Existing Plating	Rock Island Arsenal
New Plating	Watervliet Arsenal
Solvent Cleaning	Corpus Christi Army Depot
Open Burn/Detonation	McAlester Army Ammunition Plant
Ammunition Operations	Crane Army Ammunition Activity
Metal Treatment	Red River Army Depot
Regulatory Forecasting	NDCEE Johnstown

Adhesives/Sealants	Lake City Army Ammunition Plant
Mechanical Depainting	Red River Army Depot
Painting	Letterkenny Army Depot
Existing Plating	Corpus Christi Army Depot
Open Burn/Open Detonation	Hawthorne Army Depot/Iowa Army Ammunition Plant
Ammunition Operations	Milan Army Ammunition Plant
Chemical Depainting	Tobyhanna Army Depot
Solvent Cleaning	Prospective Tech.

This approach eliminates duplication of effort by designating lead centers for each category and drawing on expertise across the IOC. It facilitates the sharing of expertise, successes, and failures. Equipment purchases can be consolidated and P2 projects prioritized across IOC making better use of available dollars and resources.

P2-CTX is an outgrowth of the Army's HAZMIN CTX Program which was created to reduce hazardous waste and communicate needs to the appropriate Research and Development (R&D) organizations. It consisted of representatives from the depots and resulted in equipment purchases. The program evolved into the IOC P2-CTX Program which was formally established by the Commanding General of IOC in 1994.

IOC provides central coordination of the program. It is administered by IOC's Environmental Compliance and Pollution Prevention Division. The headquarters unit seeks funding, chairs and coordinates meetings and activities, and provides overall direction of the organization. Actual execution of the program is decentralized. The lead centers maintain expertise in their assigned areas, assist other installations as required, and develop action plans. All work together for the common goal of reducing the hazardous and toxic materials used in IOC by 50%. Current activities include reviewing all major IOC waste streams, and determining corrections to eliminate or reduce them. Ongoing R&D efforts are being reviewed to determine what gaps are left. Lead centers work with customers to revise specifications, fund studies, purchase equipment, find alternative chemicals, and monitor current actions. Other actions include maintaining cognizance of the latest technology, conducting update meetings, and exchanging information. A process specific action plan for IOC is being developed for FY98 implementation.

The P2-CTX initiated equipment purchases and actions have produced substantial cost avoidances.

New caustic solution filtration units saved \$85,000; acquisition of aqueous parts washers saved \$750,000; industrial waste water treatment plant sludge dehydrators saved \$350,000; chemical stabilization of blast media saved \$1.2 million; and elimination of the chrome conversion process saved \$195,000. Other successes include elimination of methylene chloride stripper and finding environmentally friendly solvents.

The overall purpose of P2-CTX is not research. Its primary focus is technology exchange to influence R&D communities and share successes and failures throughout IOC. The program is still young but its effectiveness is growing. Future activities will include working with other government agencies and private industry.

Single Process Initiative

The IOC has implemented the Single Process Initiative (SPI) to reduce its contractors' costs, resulting in reduced cost to the Army. The SPI promotes the use of common processes at contractor facilities. On a facility-wide basis, contractors are allowed to adopt common processes or commercial practices that meet the customer's requirements.

In the past, the Army, Navy, and Air Force would procure items on contracts. Each imposed service-specific requirements for similar manufacturing and management processes, such as inspection systems, statistical process control, and reporting requirements. To meet service-specific requirements, contractors would develop multiple in-house ways of performing the same or similar processes. This added unnecessary cost to the procurement, increased the contract management burden, increased the administrative cost, and resulted in multiple, redundant, overlapping, and non-value added requirements.

The SPI is a product of Acquisition Reform. By allowing the contractor to implement one system for common processes, the customer's requirements could be met at less cost. Motorola, located in Scottsdale, AZ, was one contractor where SPI has been applied. Four inspection systems were replaced with ISO 9001, with a cost avoidance of \$171,000. Multiple standards for Electrostatic Discharge control processes were replaced by ANSI/EIA-625, with a cost avoidance of \$36,000. A new uniform single purchasing system was incorporated using new Federal Acquisition Regulation clauses which reduced oversight, inspection, documentation, and administrative lead time associ-

ated with the purchasing system. The total cost avoidance is estimated to be \$145,000. Four military and DoD standards related to software development were replaced by a Motorola standard comparable to commercial standard EIA/IEEE J-STD-0116. Other military standards were replaced by an equivalent industry standard. As a result, less reliance was placed on inspection and more reliance was placed on statistical process control. The SPI has been successfully applied to multiple contracts, and will be applied to many additional contracts. The successes to date have shown that Acquisition Reform is working to reduce the burdens on contractors and reduce the end-item cost to the government.

Facilities

Armament Retooling and Manufacturing Support

With the Armament Retooling and Manufacturing Support (ARMS) program, Army facilities are reused by commercial industry until the facilities are again needed to support the mission of the Army. Commercial companies receive incentives to use available facilities and equipment. By considering available facilities as assets rather than liabilities, the Army is able to keep the facilities viable and available for future use, while obtaining a return on the investment in these facilities (Figure 2-1).

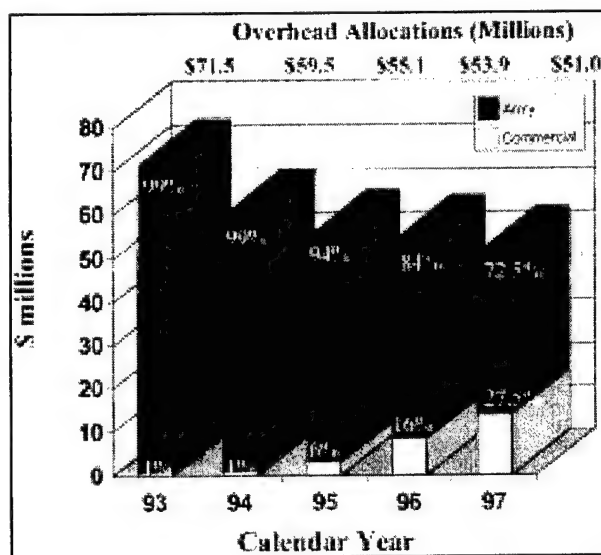


Figure 2-1. Commercial Contracts

With reduced world threats, the Army was facing the prospect of closing or downsizing many of its facilities. Many of the facilities would have required extensive expenditures to meet environmental standards, and maintenance and rehabilitation costs. The ARMS Act - P.L. 102-484, which encourages the commercial reuse of mission required plants, allowed the Army to award contracts to businesses using the assets. The facility contractor is contracted to maintain and manage the building(s) and equipment. The Army liability is limited through contract clauses. The arrangement reduces the product costs of the activity with the reduced overhead and the income from the production at the facility. The personnel employed by the Army are typically employed by the leasing firms, maintaining the skill base in the area in the event the facility needs to be reopened in the future. Eleven plants participate in the ARMS program; nine are inactive plants and two are active. The IOC plans to expand the arrangement to include depots, Government Owned-Contractor Operated (GOCO) facilities, and labs. The value of a facility is much greater when the facility has tenants currently occupying the space. Since 1994, more than 1,000 ARMS proposals have been evaluated. The initial expenditure for starting the program was \$99 million. The break-even point is 4.8 years, or 9.9 years if only the guaranteed returns are included. The benefits to the Army may be used for environmental remediation, reduction of maintenance costs, reduction of product costs, as well as other projects necessary for facility operation. Examples include \$14 million of overcost being absorbed by one facility in 1997, with two inactive plants operating at no cost to the Army. Additional savings at active plants will occur as ARMS projects are completed. Four more inactive plants should operate at no cost to the Army in calendar year 1999.

The ARMS reduces the costs of ownership and divestiture to the Army. The communities benefit from the reutilization of the facilities, and by keeping jobs in the area. The Army benefits by keeping the facilities and equipment available for future use and maintaining skills needed for any future re-opening of the facility.

Logistics

Ammunition Surveillance Information System

The IOC developed a new computer-based Ammunition Surveillance Information System (ASIS) that uses commercial laptop computers, commercial software, and Compact Disc (CD) media for accessing technical data.

The ASIS had been paper based using files, microfiche, engineering drawings, and technical manuals. This process forced field ammunition inspectors to make judgements from memory, or return to their office to perform research which increased costs while degrading the ammunition stock pile. The laptop computer enables ammunition inspectors to review and research all data associated with the DoD inventory at the inspection site. Information available on the laptop computers includes applicable engineering drawings, technical data, suspensions, safety notices, ammunition history, and inspection forms. Over 100,000 pages of text and more than 11,000 drawings have been placed on CD media for access with the ASIS (Figure 2-2).

At many Posts, Camps, and Stations, the field inspection of ammunition shipments, receipts, and storage practices are delayed because inspectors must return to their office for the needed manuals or bulletins. When research is complete, an inspection form is filled out and forwarded to an input station where the data is entered into a main frame computer. Information on the ammunition is updated and can include condition code changes, comments on packaging, movement, safety, and recommendations for maintenance or destruction. During volume movements, this loss of inspection time can be detrimental to the storage site or the retail unit.

The new ASIS provides the inspector immediate on site input capability during the inspection process. It provides the field inspector all data to properly identify, classify, package, mark, ship, and store DoD ammunition. All technical manuals, ammunition information notices, restrictions, bulletins, engineering drawings, and regulations are available on the laptop PC that is carried with the inspector. The off-the-shelf system can be safely carried and used in storage structures, buildings, ships, and vehicles. Laptop hard drive updates are provided through electronic mail; CDs are updated semiannually.

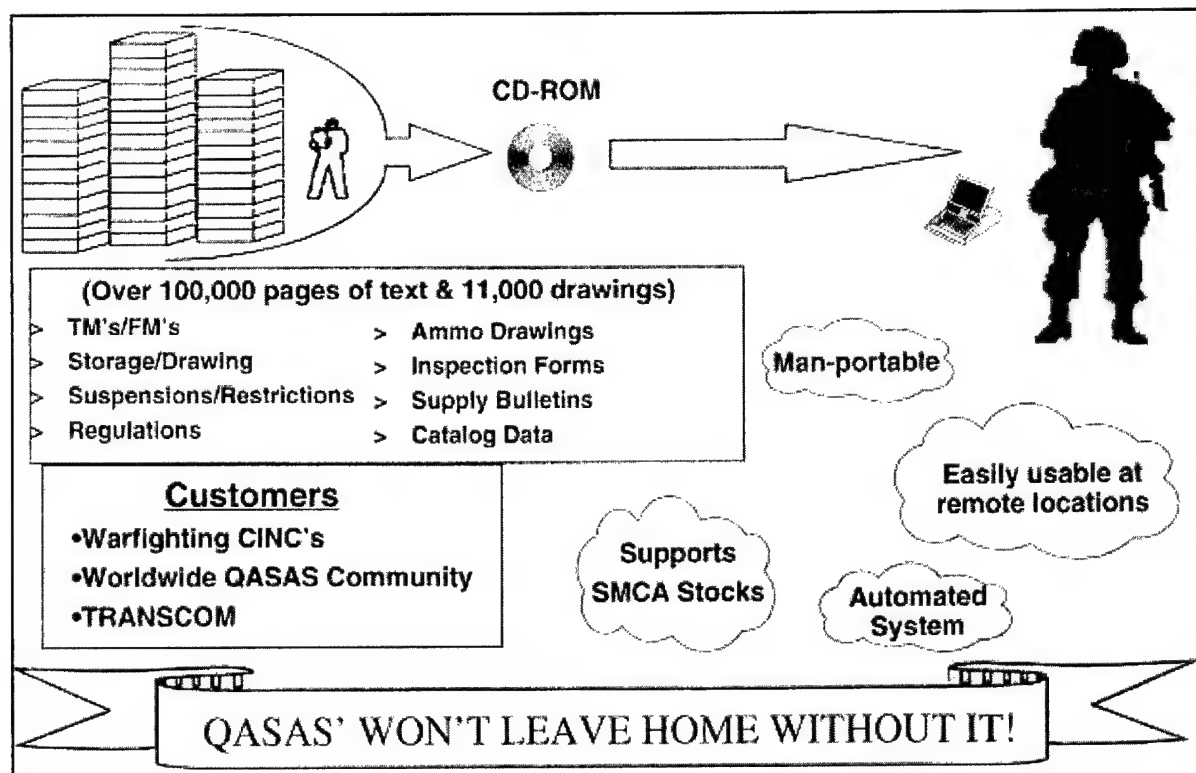


Figure 2-2. Ammunition Surveillance Information System Process

Currently, 170 laptops are fielded at Army sites, and another 21 laptops are being purchased at \$6,500 each. The economic analysis (EA) on the ASIS showed benefits in reduced research time; single data entry; complete research library; more accurate condition coding; and efficient and effective inspections.

The EA also showed a \$1.4 million savings primarily in labor costs. Substantial intangible benefits are realized through increased transportation safety, enhanced storage safety, and improved use of DoD ammunition. This is brought about by vast amounts of information available to the inspectors. Established ammunition sites are also expected to realize similar benefits.

Inventory Accountability - Ammunition

The IOC developed the Ammunition Inventory Accountability Program as a result of the wholesale ammunition study conducted from July to October 1993. This study demonstrated numerous problems with the inventory program at the time which included low accuracy rates, labor intensive counts, multiple counts of the same National Stock Number (NSN), and was cost-prohibitive. The new pro-

gram began November 1, 1993 and was designed to reduce labor costs, increase accountability of ammunition, and maintain stability in the inventory program. Long term goals included increased use of technology, elimination of paper use, and reduction in the inventory staff required at the installations.

The new program is designed for a single site visit to perform a physical inventory count. Every site is counted 100% regardless of the number of NSNs, condition codes, or grids. This information is compiled and researched for a total installation balance of all NSN's inventoried. It requires that a core staff of full time permanent researchers be on the installation at all times, but allows the use of contractors or temporary labor to perform counts. This saves inventory budgets by allowing fluctuations in the workforce as required, but without maintaining overhead when the counts are completed. The new program includes a sealed site process, which eliminates that site from count the following year if no stock movement has occurred. It also increases ammunition reconciliation frequency from quarterly to monthly, which reduces the number of adjustments required because of the shorter time frame between audits.

The former program required multiple visits to each site during the inventory cycle because it was based on a location count. This caused repetitive hours of research to be performed with substantial adjustments to the accountable record due to material that was out of location, but not lost. These constant adjustments to the record negatively impacted readiness and degraded visibility of the assets.

Reduced Property Administration

The Federal Acquisition Regulation (FAR) Part 45 requires that Government Property at GOCO facilities be adequately controlled and managed to maintain accountability. This requirement has applied regardless of the cost of the item of property. The IOC is taking actions to reduce the cost and manpower involved with property administration of the low cost items, and to minimize the effect of government regulatory requirements felt to be contributors to unnecessary costs.

Property administration has typically involved paying a contractor to establish and maintain records for property under their control, maintain a location tracking system, and conduct periodic physical inventories. A project to reduce the effort and cost expended to manage low value items was instituted in 1994 followed by processing a regulatory deviation in 1995. It was felt that more resources were being expended to extensively manage items of low value (less than \$1,500) than was appropriate for any benefit gained. As an example, at Iowa Army Ammunition Plant, the 30,000 low-value property items encompassed 90% of all items, but only 10% of the total property value. The reduction of property administration by eliminating the tracking and location control requirements and periodic physical inventories, resulted in full property administration controls being applied to only 3,359 of the original 33,884 line items. Paperwork for physical inventories was reduced by 75%. Reduced property administration at ten Army Ammunition Plants for this contract year has resulted in \$650,000 in contract negotiated cost savings. An additional \$257,000 savings at five more plants is expected. Substantial cost avoidances are also anticipated for future contracts.

Efforts are continuing to pursue additional reductions in property administration making government requirements more comparable with industry where all items less than \$1,500 are often

expensed. Eliminating accountability of low value items at government operated facilities is also being pursued to further reduce costs. As part of the "Reinvention Laboratory" process, the IOC is working toward approval to expense items less than \$2,500, thus removing them from property administration requirements and realizing additional savings.

Management

Alternate Disputes Resolution

The IOC has developed an effective methodology for resolving disagreements with prime contractors before they become adversarial issues and formal contract disputes. This change was driven by recent Government initiatives for acquisition reform as well as by a recognized need to reduce the time and expense involved with resolving issues through litigation.

Prior to initial implementation in late 1995, many issues and disagreements with prime contractors were settled through the Armed Services Board of Appeals or the Court of Claims under the Contracts Disputes Act. This consumed significant resources in litigation and fostered adversarial relationships with contractors. Previous major contracts for the 120MM Mortar program and the HYDRA 70 Rocket program had a multitude of dispute actions and continuing unresolved claims. Claims for one program exceeded \$30 million.

In 1995, the IOC developed a process for Alternate Dispute Resolution (ADR) for subsequent contracts for these two programs. The approach emphasized the need for partnering with industry, and identified to potential contractors the need to commit to resolving contract problems at the lowest possible level.

A key part of the process includes identifying to bidders, up front or in the solicitation, that partnering arrangements and any associated costs in training and implementation will become formalized. This includes identifying which parties and levels are appropriate for early resolution, and also a step-by-step process for resolution of continued disputes at those levels. A primary addition to partnering under ADR is the implementation of "Assisted Negotiation" where a neutral third party is identified in advance by both sides to listen to the issues and recommend actions for resolution prior to mediation or arbitration.

A lesson learned in implementing the ADR process is that all organizations involved (contracting office, contract administration, contractor, and sub-contractors) must be willing to expend the resources necessary to ensure effective teaming and partnering. This is best facilitated through training and workshops, using an experienced third party source. Programs selected for the ADR process must be carefully chosen, as a significant amount of time and personnel resources may be required to implement the process. Identification of the effort involved in ADR should be addressed up front in the proposal.

Partnering, combined with establishing ADR procedures, has shown to significantly improve the chance for success on complex contracting actions. Many types of claims encountered on previous contracts for the 120MM Mortar and HYDRA 70 Rocket programs were avoided on the subsequent contracts by using ADR. For example, on-time delivery schedules were maintained, working relationships have improved through use of less adversarial methodologies, and claims or disputes have diminished. The improved relationships had the additional benefit of contributing to resolution of some old claims on the previous contracts.

Leadership Development Strategy

The IOC recognized that the key to making improvements happen depended upon the leadership and their effectiveness as leaders, coaches, facilitators, and strategic planners. In the past, only informal leadership assessment techniques were performed. In order to develop the leadership skills and abilities within the command, a top-down leadership assessment questionnaire was developed, being first used with the Commanding General. An automated program displays data from questionnaires for analysis purposes, and for senior leadership review and use. Currently the assessments are being used at Headquarters, IOC, McAlester Army Ammunition Plant, Red River Army Depot, Letterkenny Army Depot, and

Tobyhanna Army Depot. The questionnaire allows personnel to provide input that will be used constructively to enhance the leadership skills of management. At all of the activities, except Tobyhanna, the inputs are anonymous. The manager is required to develop an improvement plan and then share the plan with the person making the suggestion. The benefits of the assessment questionnaire include the identification of strengths in leadership skills, and abilities and areas for improvement. A mind set is fostered for continuous improvement of personal leadership strategies.

The design of the leadership assessment questionnaire is critical to its effectiveness (Figure 2-3).

THIS IS HOW I RATE MY CG'S PERFORMANCE				
PERFORMANCE	THE BEST	GOOD	OK	NEEDS IMPROVEMENT
Caring				
Visionary				
Competent				
Accessible				
Spends enough time with my organization				
Spends about the right time with the entire IOC				
Allows CDRs & Staff freedom to make decisions				
Takes risk				
Makes tough decisions				
Provides direction vice instructions				
Leadership				
Comments:				

Figure 2-3. Leadership Assessment Questionnaire

The questionnaire must inquire about the demographics of the population completing the questionnaire in order to adequately identify areas for improvement. Any corrective actions identified must be worked immediately to maintain credibility. Assessment results and planned improvement activities must be given to those who participated in the process. The assessment should not be conducted anonymously; it requires open, honest communications between leaders and their people on strengths and areas for improvement. Management must be willing to accept risk, be receptive to comments from employees, and be willing to take immediate action on improvements. The Leadership Assessment Questionnaire has been highly successful because of the culture that has been developed throughout the IOC and its commands.

Team Building Strategy

Over the past three to five years, the IOC has been implementing a team building strategy to improve operational effectiveness and customer satisfaction. The focus is on self-managed teams and is supported by effective team building tools and support systems. Previously, the IOC and its predecessor organizations were stove pipe type organizations characterized by duplication of effort, poor communication, and confusion among customers about whom to interface with at headquarters and the installations. The IOC was created from the merger of two distinct organizations that needed to develop effective ways of working together internally and understanding each other.

Under the new strategy, self-managed teams bring together cross-functional experts onto one team. This was accomplished by benchmarking and planning to put in place a structured team building methodology and support system. Personnel were trained in team concepts and skills. Each team charter provides well-defined roles and responsibilities adopted by the team members. The charter also specifies team responsibilities, team membership, personnel management arrangements, and other details. High impact start-up workshops are conducted to launch the teams. The workshops are followed up with regular team maintenance sessions. Senior level managers work with the teams as mentors, coaches, and champions to help ensure success.

Training and tools, such as Honesty, Ethics, Accountability, Responsibility, Training, Support (HEARTS), help make the team building strategy work. HEARTS is a command-wide team building training program for the IOC associates. It consists of a three-phase process that blends indoor classroom instruction with outdoor experiential learning techniques. HEARTS' objectives focus on personal breakthroughs and shifts in traditional mind sets, high performance teamwork, and process management and improvement within organizations. Nearly 7,000 people within the IOC have completed at least phase one of this three-phase program.

Teams are being taught and applying 360 degree performance evaluation techniques. A cadre of 15 certified instructors in the Myers/Briggs Personality Trait Indicator (MBTI) technique conduct team building workshops throughout the command utilizing MBTI with all levels of the organization. A team support group has been formed to assist teams as required. These kinds of support and training tools are the foundation for an effective team building strategy.

The team approach has worked well for the IOC, resulting in greater efficiency and customer satisfaction. It is estimated that teams have reduced personnel resource requirements by one-half while maintaining productivity and quality. Employees receive a great deal of satisfaction through benefits derived from working as a team. In many cases, two to three levels of supervision and traditional management structures have been eliminated.

Section 3

Information

Logistics

Acquisition Tracking Center Streamlining

The IOC Acquisition Tracking Center (ATC) provides centralized tracking and reporting for major Conventional Ammunition Working Capital Fund (CAWCF) and Production Base Support (PBS) procurement programs. A minimum threshold of \$500,000 has been established for tracking by the center, which includes 80% of CAWCF and 60% of PBS program actions encompassing approximately \$870 million in procurement. Presently, there are 120 ATC tracked procurements, each of which may represent multiple customer orders. A plan is being implemented to streamline and automate the existing tracking process.

The present process requires redundant manual data input, physical routing of forms for annotation by functional elements, and monthly hard copy reports for use by milestone managers. When faced with downsizing of the workforce and an ever increasing need to provide timely visibility to any problem that could affect the planned obligation of funds, the IOC began a program to improve effectiveness and establish a process which eliminates many of the manual steps. There are 13 major milestones in the acquisition process which are tracked through time periods as long as 18 months. The first milestone monitored is receipt of funds, with tracking continuing to contract award. The streamlined process is intended to provide online viewing, real time updates, more visibility for managers, and better accuracy when implemented by October 1997.

The streamlined process uses an ORACLE database combined with "Form Flow" and electronic mail. Data will be downloaded from the existing Commodity Command Standard System (CCSS) on a daily basis creating an electronic form for processing. This will be routed by electronic mail to the functional offices required to supply data. The pulling of data from an existing database and the processing of electronic forms will eliminate the need for redundant data entry by the ATC. It is also anticipated that this will eliminate a potential

source of errors. Up-to-date, online viewing capabilities will eliminate two ATC book report printings and about 15,000 pages of paper each month. The streamlined process also links to the IOC Enterprise Information System which provides electronic summaries to the Command Group, Deputy Chiefs of Staff, and milestone managers.

This system is planned to be fully operational in fiscal year 1998. Projected benefits include more efficient, accurate, and timely processing; elimination of paper routing and reports; and improved accessibility of up-to-date status on major program procurement. This system will extract data from existing databases and supply information to an existing automated reporting system. Although no cost avoidance figures have been published at this point, the benefits from improved accuracy and more efficient processing are expected to be substantial. The availability of online viewing with real time processing, which provides program status to all levels within the organization, is seen as a significant improvement in managing the ammunition procurement programs.

Asset Stratification

The new stratification process allows all U.S. military services to review Army assets in excess, economic retention, and contingency stock for potential cross leveling. This can preclude redundant purchases by the services. This system has continued to evolve over the last twenty-five years—from a manual system, to a main frame computer system, to the current personal computer-based operation. Improvements were prompted by the continuing DoD downsizing and/or review of the DoD ammunition stockpile by the GAO in 1996.

The improved stratification system will incrementally provide other services the ability to cross level munition stocks from Army assets. Coordination between Headquarters Department of the Army, Army Material Command, and the IOC to form a joint management review of asset posture is a cornerstone of this effort. As these reviews continue to reflect real world item management concerns, they will undoubtedly prove valuable to DoD ammunition management. The creation of the

Ammunition Management Improvement Coordination Committee by DoD should encourage other services to follow the Army's lead in development of visible ammunition databases.

Earlier phases of the system allowed stove pipe purchases and stockpiling. This added substantial DoD excesses in ammunition procurement. Deletion of weapons systems by item managers, with minimal coordination of ammunition purchasing activity, adds to a lack of communication between services.

Although the Army is the recognized leader in the development of asset visibility, there are concerns about bridging between classified and unclassified systems in identifying requirements. The meshing of multiple databases within the Army and from the other services will continue to be challenging. The collation of these sources must take place for a true picture of asset accountability and visibility to be a reality.

Management

Ammunition Business Process Re-Engineering

The Army IOC manages conventional ammunition and related items throughout their life cycle for all DoD services, including supplying ammunition from production to storage and on to the front lines. The IOC is in the process of implementing a computerized manufacturing resource planning system (MRP II) throughout the Command to improve its on-time deliveries and reduce delivery lead times.

The current system to be replaced is an analytical and administrative procedure that determines program prices, prepares budgetary documentation, develops production schedules, monitors program performances, ensures end item delivery to the customer, and generates bills of material. The system consists of manual/semi-automated processes and fragmented automated information systems. This is complex and labor intensive. Another major problem is that anybody can make changes to the system.

Congressional inquiries, downsizing, and limited resources in the early 1990s lead to the need for system improvements and efficiencies. The IOC acquired a contractor to provide the technical advice and support for the program. Systems planning, implementation, and utilization practices of other companies were studied and benchmarked.

Lessons learned were analyzed and applied to establishing a good plan and understanding of the system. Improvements were identified in the areas of simplifying and standardizing processes; eliminating redundancy and duplication; and improved personnel productivity. Efficiencies would be met through the adoption of an integrated automated system. Examination of the IOC's internal processes and the downstream effect on other installations lead to the selection of a PC-based system using off-the-shelf Cincom Control MRP II software. Targets for improvement include:

- **Resource Management:** Apply standard/consistent control policies established for finance, order acceptance, production, inventory, purchasing, and engineering.
- **Price and Budget Development:** Replace manual system with automated pricing development, automated budget processing, and variance analysis.
- **Processing Customer Orders:** Reduce ordering process to one day.
- **Plan/Monitor Program Execution:** Automate tracking of production order status.
- **Manage CAWCF Inventory:** Inventory management becomes a system driven activity.
- **Customer Service:** Improve responsiveness of information to less than two minutes.

Phase I of the program is near completion, with Phase II in process. Phase III, full-scale implementation, is scheduled to start in mid-1997 with a planned 18-month completion. Projected benefits will be the elimination of variations in data between systems; on-line ability to track orders; improved accuracy and accountability; standardized and streamlined processes; reduced response time to customers; reduced number of report revisions; improved communications; and an integrated systems/relational database.

Business Forecasting, Receipt and Issue

The new procedure for forecasting the shipment of ammunition and receipt of short tons for installations is based on plans and estimates from military theaters around the world, Continental United States (CONUS) movement, and projections from other services. The forecast is designed to provide depots and arsenals a means of developing costing rates, manpower estimates, and storage space requirements for the pending movements. The former

method was a manual forecast developed by Item Managers (IMs) in a total review of the types of items to be moved in a given year. This was labor intensive, expensive, and time consuming.

The current methodology for developing ammunition movement forecasts considers several factors. First, the Army's Tiering System delineates where high priority stocks should be placed for mobilization contingencies. As transportation and re-warehousing dollars allow, the war readiness materiel coming from overseas and new production items are designated to go to installations responsible for immediate support to combat areas. Training support for all services is factored, as are installation storage capabilities for the material being moved. Pre-position materiel returns from support vessels at sea and replenishment stocks for the ships are also considered. Another major element is the Base Realignment and Closure actions. Those decisions force the relocation of thousands of tons of ammunition each year to designated CONUS sites.

The former method of forecasting was essentially a line-by-line scrub of the material managed by IMs within the Single Manager for Conventional Ammunition at Rock Island. This review was designed to consider, individually, which items would move during a given year based on the factors listed above. This was extremely time consuming and labor intensive but provided a more detailed plan for the installations to manipulate their funding and manpower. The new procedure has just been implemented, and noticeable benefits have not yet materialized. The IOC is striving for a forecast that is more than an estimate to assist its customers for budgetary considerations and its subordinate installations for planning purposes.

Command Wide Presidential Quality Award Strategy

The IOC adopted a strategy to utilize internal Presidential Quality Award (PQA) assessments at the Headquarters and subordinate installations. This was initiated to strengthen the in-house analysis capability to identify organizational strengths and areas for improvement against the stringent and structured criteria of the PQA. Prior to adopting this strategy, no formal assessment process existed. Informal organizational assessments were conducted by one or two installations. No command-wide approach or standard set of assessment criteria

were used. There was no structured process for determining and assessing improvement initiatives.

PQA Assessment Teams conduct organizational assessments using the Baldrige-based PQA criteria. Assessment reports are presented to senior leadership with a proposed plan for improvement. Assessments must result in a corporate improvement plan. Commitment by the senior leaders in each organization is the key to making this strategy successful. Senior leaders set the pace for change, energize execution of the corporate improvement plan, and create momentum toward success. The leaders participate in annual IOC Change Agent Forums to exchange strategy information within all seven PQA criteria areas. At these forums, installations learn from each other and from industry participants such as Xerox and Saturn about what is working and what is not working. They share successes and lessons learned. Training is also important. There are now 25 certified PQA examiners within the IOC Headquarters and subordinate installation structure. Formal PQA assessments have been conducted at the Headquarters and 11 subordinate installations.

The PQA assessment strategy provides the IOC organizational performance information that can be used to initiate corporate improvement strategies. IOC is using this approach successfully to reduce costs, and improve efficiencies and customer satisfaction.

Customer Satisfaction Measurement

The Army IOC has been undergoing significant changes over the past several years due to downsizing and Base Realignment and Closure actions. The Army is building a new command that is lean, customer-focused, and cost-conscious. Wanting to make changes that are responsive to customers' needs, the IOC is aggressively soliciting feedback from customers. Part of this new culture is a formalized process for collecting customer satisfaction.

In the past, customer satisfaction feedback was informally obtained through discussions with customers who contacted functional personnel. No systematic measurement was performed on data collected from customers. The measurement data was therefore not available for constructive use toward implementing improvements and taking action to correct problems.

The new process utilizes a customer satisfaction questionnaire for major customer groups of the IOC. A two-page questionnaire captures frequency and type of products and services used from the IOC; the installation the customer deals with most frequently; a rating of the quality, cost, value, and timeliness of the products and services delivered; and a rating of the IOC staff regarding their knowledge, responsiveness, follow-up, efficiency, and courtesy. An automated program has been developed which processes and displays the data for analytical purposes. The results can be presented to senior leadership for implementation in planning for improvement and corrective action.

Formalized customer surveys are a relatively new initiative employed by the IOC, and survey data is being compiled and analyzed. Continuous use of the customer satisfaction questionnaire will lead to consistent and reliable metrics that can provide the basis for improving customer satisfaction through improvements of the IOC's business processes.

Electronic Travel Order System

Business travel for an employee to a designated site requires a set of approved travel orders. The Army IOC significantly reduced its labor and processing time for travel orders with the implementation of an Electronic Travel Order System (ETOS). The system resides on a PC-based system using Microsoft C for DOS version 6.0. Electronic mail is used for routing and distribution, using RAIMA data manager Software for UNIX and DOS.

Prior to 1993, travel orders for IOC employees were processed manually. The appropriate travel information was typed into each block on DoD Form 1610 and hand carried through management areas for review and approval. Each travel order was reviewed for correctness, cost data, date issued, and order number. Copies of the travel orders were hand carried to the Scheduled Airline Ticket Office for tickets, travel advances, and manual input into the accounting system. The travel order number, traveler's name, travel date, and destination were then entered by hand into the travel log.

The old travel process was first reviewed in 1989 as an area where improvements could produce significant benefits. The new ETOS process, brought on-line in 1993, introduced electronic processing of travel orders for the IOC. The system sets up a database of office and personnel information; ini-

tiates a travel order into the system by picking appropriate personnel/office data which automatically fills in the blocks on DoD Form 1610; electronically routes, reviews, and approves travel orders; allows on-line approval and corrections; automatically assigns issue dates and travel numbers; and prints out the travel order, finance, and ticketing for the traveler.

The system has been electronically processing travel orders since 1993. The system provides the capability to electronically create, copy, edit, distribute, and delete travel orders. The travel log is automatically created, and the system provides on-line obligation of travel to the internal operating budget funds. IOC processed an average of 700 travel orders per month in 1996 using the ETOS, realizing a 60% reduction in processing time over the old manual methods. Processing time to physically move paper travel orders was reduced from five days to less than one day with the new paperless system.

Enterprise Information System

The Enterprise Information System (EIS) is an IOC-wide automated system that delivers critical business information to the desktop of anyone who needs the information immediately. The system provides the business intelligence that management needs, eliminates manual paper reports, and reduces meetings and briefings.

Previously, management used manually prepared data during quarterly reviews to obtain information. Typically, the information was presented too late to make a difference in the operation. Hard copy reports were used, multiple meetings were conducted involving large numbers of people, and management needed update briefings to stay informed. In many cases, the information needed was not available.

A cost benefit analysis was conducted to determine if an EIS would be cost effective. The analysis revealed that a huge return on the investment was possible. The technology needed to develop the system had become available. Enterprise licenses for the operating software were purchased and the system was developed. Recurring information requirements, such as metrics and process performance data, were identified. The data is drawn from automated sources when available. Manual entry is performed when there is no automated source. Standard presentation formats were built. The EIS has been fielded to 21 IOC installations.

The system uses a graphical Windows environment, allowing users to simply point and click to obtain the necessary data. Drill down features allow users to reach the level of detail needed. Charts, graphs, and narrative are supported by the system as well as trend analysis, exception reporting, forecast and projection analysis, and custom analysis. The EIS is accessible through any common telephone line.

Many hard copy reports have been eliminated, meetings and briefings have been reduced, and personnel have access to factual information needed to enhance their decision making capability and improve job performance. The information is simultaneously available to all users. Upper management has an automated tool that saves time and provides value. The EIS is continually being expanded and improved. The system has been operational since 1995 and has shown significant reductions in the amount of paper generated and has provided instant access to the information that management needs to effectively manage the operations.

Labor Relations

There are 65 separate labor bargaining units throughout the Army IOC. Since 1995, IOC has been encouraging its installations to adopt a new process, Partnership Councils, to improve communication between labor and management. Prior to this process, relations between labor and management at most installations were generally adversarial. Negotiations concerning any prospective changes in work rules or conditions were usually conducted in a climate of conflict and distrust. The Partnership Council process was developed to provide an effective way for management and unions to work together. The impetus for Partnership Councils came from the National Performance Review which encourages partnerships between management and unions.

Partnership Councils are comprised of representatives from the union, or unions, and management. They meet to jointly consider and approve or disapprove changes to employee working conditions. The process facilitates communication and gives each side an equal share in reaching an appropriate decision. Unlike the adversarial setting for negotiations, this approach is effective because it facilitates buy-in and ownership of the outcome by both management and labor. Changes in work rules using this process are usually much

easier to obtain and implement. Avoiding negotiations, mediation, arbitration, and labor rulings saves time and money.

Many installations in the IOC have adopted Partnership Councils and have achieved significant improvement in labor relations. In 1995, the Red River Army Depot in Texas received the President's National Partnership Award. Letterkenny Army Depot and Tobyhanna Army Depot were runners-up for the award that year. Installations using this process have learned that labor-management partnerships can be very effective if both parties are committed to the process.

Out-placement Tools

Base realignment and closure (BRAC) actions within the Army IOC have required difficult human resource decisions affecting the total population of the command. Through an aggressive out-placement program, IOC has minimized involuntary separations, while maintaining a flexible, responsive, and highly capable organization.

BRAC 91 directed the merger of the Headquarters, U.S. Army Armament, Munitions, and Chemical Command (AMCCOM) and Headquarters, U.S. Army Depot System Command. This merger formed a new command—the Industrial Operations Command—headquartered at Rock Island Arsenal (RIA). The merger resulted in human resources being relocated from Chambersburg, PA to Rock Island, IL. Reaffirmed by BRAC 93, the Headquarters, IOC was established at Rock Island during FY95. Additionally, the AMCCOM armament and chemical missions transferred to the U.S. Army Tank-Automotive Command (TACOM) in Warren, MI.

Since FY93, downsizing and BRAC closure initiatives have affected the IOC. The workforce population has been reduced from more than 42,800 to 23,300 through reassignments, transfers, relocations, retirements, resignations, and reductions in force (RIFs). Highest priority of the Command has been to provide a variety of out placement mechanisms and resort to involuntary separations, such as RIFs, only as a final option. Since FY93, fewer than 850 involuntary separations have occurred from the initial 42,800 employee workforce. This success can be attributed to an aggressive out-placement program that keeps employees well counseled on out-placement tools available to them. Out-placement offices were established at various installations to provide employee guidance, counsel,

and assistance in making difficult transition decisions. The out-placement program developed fair and consistent policies and procedures; helped employees with the widest possible range of choices for their future; and allowed affected employees time to plan their future while maintaining morale and an orderly transition to a smaller workforce.

Out-placement tools consisted of Voluntary Separation Incentive Pay (VSIP); VSIP Phase II (an expanded version of VSIP); Priority Placement Program; Out-placement Subsidy (a BRAC initiative allowing pay for moving expenses); Non-Federal Hiring Incentive; Voluntary RIF (allowing employee full severance pay depending on service time, age, etc.); Interagency Career Transition Plan (allowing transfer and training); and Retraining Grants (Joint Training Partnership Act provides \$5,000 to \$10,000 grants per employee for training).

Out-placement offices at the various IOC installations maintain close interface and coordination with each other, as well as with their state and local governments and businesses for placement opportunities. Employees receiving involuntary separation are provided guidance and assistance in preparing resumes and job placement outside Army and DoD organizations and non-government organizations.

Major reductions occurred during FY93 through FY95, with some level of workforce stability experienced in FY96 and continuing into FY97. With the aggressive out-placement program and strong support of the Headquarters, IOC, involuntary separations have been minimized to less than 5% of the total losses. Integrity of the IOC organization remains flexible, responsive, and highly capable to serve its customer needs.

Partnering Strategy

The IOC has developed a partnering strategy between government and contractor staffs that has eliminated undesirable effects of the traditional adversarial relationship that existed for years. Previously, there were limited amounts of cooperation and teamwork between government and contractor staffs at IOC installations. This often resulted in strained relations, duplication of effort, cycle time delays due to poor communication, and increased administrative costs. The new partnering strategy was developed to enable IOC to become a more responsive and efficient organization with improved customer and employee satisfaction.

The partnering strategy was initiated through team building and planning activities at the senior level of the organization. A series of workshops was conducted at each participating installation. The purpose of the workshops was to develop and begin implementing process improvement initiatives for the installation through cooperation, joint participation, and communication. Partnering strategies have been successfully implemented at the following installations—Hawthorne Army Depot, Radford Army Ammunition Plant, and Iowa Army Ammunition Plant. Headquarters partnering strategies include the following program team—Hydra 70 Team, Chem Demil Team, and the 120 Tank Ammo Team. The IOC found that partnering effectiveness was enhanced by documenting the initiatives within partnering agreements among the senior leaders involved.

Implementation of the strategy has helped reduce resources and duplication of effort while improving efficiencies and customer satisfaction. Employee satisfaction has improved as a result of working as a team with contractor personnel. Many traditional management structures at the branch and division levels were eliminated, thereby significantly improving work flow and cycle time.

Procurement Action Management System

The Deputy Chief of Staff for Acquisition (DCSAC) organization in the IOC utilizes an automated tracking and reporting system for all procurement projects. This system identifies those Procurement Work Directives (PWDs) that have exceeded pre-established time frames for completing milestone procurement actions inherent in the procurement process.

The Procurement Action Management System (PAMS) was established in 1995. All managers within the DCSAC were trained, and final implementation was completed in December 1996. This system automatically tracks each procurement action from receipt of a certified PWD with any associated technical data until the issuance of a contract. Data is extracted from the existing Commodity Command Standard System. Intermediate milestones monitored include assigning the project to a buyer, issuing a solicitation, bid opening or cut off date for proposals, and awarding the contract. Internal time frames were established for alerting

successively higher levels of management when milestones were not achieved. These levels start at the Contracting Officer and continue through the branch, division, and DCSAC levels. Separate time frames are established for competitive and non-competitive procurement. The PAMS automatically reports to the appropriate management level those PWDs that are out of tolerance with the time frames established for that level. This notification gives each successive level the visibility to see which are exceeding expected Procurement Administrative Lead Times (PALTs) providing the opportunity to take necessary actions. Each manager within the DCSAC office has computer online access. The PAMS automatically provides procurement action status through the IOC Enterprise Information System which provides current visibility on PWDs to all management levels and organizations within IOC.

The PAMS is used as a tool to track individual procurement projects, provide visibility to procurement activity, and progressively escalate identification of programs that exceed PALT guidelines. In 1996, the IOC maintained an average PALT of 109 days as compared to a higher command (Army Materiel Command) standard of 300 days. The PAMS is not directly tied into reporting trends or goals for reducing average PALT for the organization, but is aimed at identifying individual problems as early as possible. A change to the system is in process that will allow use of the system at the buyer level within the organization.

Staffing Analysis

Staffing Analysis is used to measure time and manpower requirements to accomplish established missions. It can also be used to evaluate contractor efficiency. The new process will establish workload and manpower on spread sheets based on five-year history information. Information on factored quantities of production and equivalent units of end items would be used as a base. The prior methodology set standards, conducted time and motion studies, conducted work sampling, and estimated labor efficiencies. It relied heavily on labor and personnel review.

The new process can measure direct and overhead labor in both maintenance and logistics areas. In addition to the five-year history, data is developed from standards based on end item production. Site information is developed as it pertains to each installation's workload. It can be used for establishing and justifying staffing levels. The current program has been successfully used at three Army Ammunition Plants.

The earlier program relied heavily on personnel measurement that set rigid standards through time studies and work sampling. It also used labor forecasts and efficiencies in an effort to qualify the standard. This detracted from ethical reporting and workforce effectiveness because of fears in labor and supervision of manpower reductions.

The IOC estimates 10% of the previous standards are still used and could provide a basis for the new analysis to be implemented. Benefits in preparing Economic Analyses could also materialize by expanding the new review to all IOC installations.

Appendix A

Table of Acronyms

Acronym	Definition
ADR	Alternate Dispute Resolution
AMC	Army Materiel Command
AMCCOM	Armament, Munitions, and Chemical Command
ARMS	Armament Retooling and Manufacturing Support
ASIS	Ammunition Surveillance Information System
ATC	Acquisition Tracking Center
BOA	Basic Ordering Agreement
BRAC	Base Realignment and Closure
CAWCF	Conventional Ammunition Working Capital Fund
CCSS	Commodity Command Standard System
CD	Compact Disc
CONUS	Continental United States
DCSAC	Deputy Chief of Staff for Acquisition
DoD	Department of Defense
EA	Economic Analysis
EIS	Enterprise Information System
ETOS	Electronic Travel Order System
FAR	Federal Acquisition Regulation
GAO	General Accounting Office
GOCO	Government Owned - Contractor Operated
HEARTS	Honesty, Ethics, Accountability, Respect, Trust, Support
IM	Item Manager
IOC	Industrial Operations Command
ISO	International Standards Organization
LLRW	Low Level Radioactive Waste
MBTI	Myers/Briggs Personality Trait Indicator
MRPII	Manufacturing Resource Planning System

Acronym	Definition
NSN	National Stock Number
OCONUS	Outside Continental United States
P2-CTX	Pollution Prevention Center for Technical Exchange
PALT	Procurement Administrative Lead Time
PAMS	Procurement Action Management System
PBS	Production Base Support
PQA	Presidential Quality Award
PWD	Procurement Work Directive
QBL	Qualified Bidders List
R&D	Research and Development
RIF	Reduction In Force
SPI	Single Process Initiative
VSIP	Voluntary Separation Incentive Pay

Appendix B

BMP Survey Team

Team Member	Activity	Function
Larry Robertson (812) 854-5336	Crane Division Naval Surface Warfare Center Crane, IN	Team Chairman
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Larry Halbig (317) 306-3838	Hughes Air Warfare Center Indianapolis, IN	
Rodney Huff (801) 833-2181	Tooele Army Depot Tooele, UT	
Rick Purcell (301) 403-8100	BMP Center of Excellence College Park, MD	

Appendix C

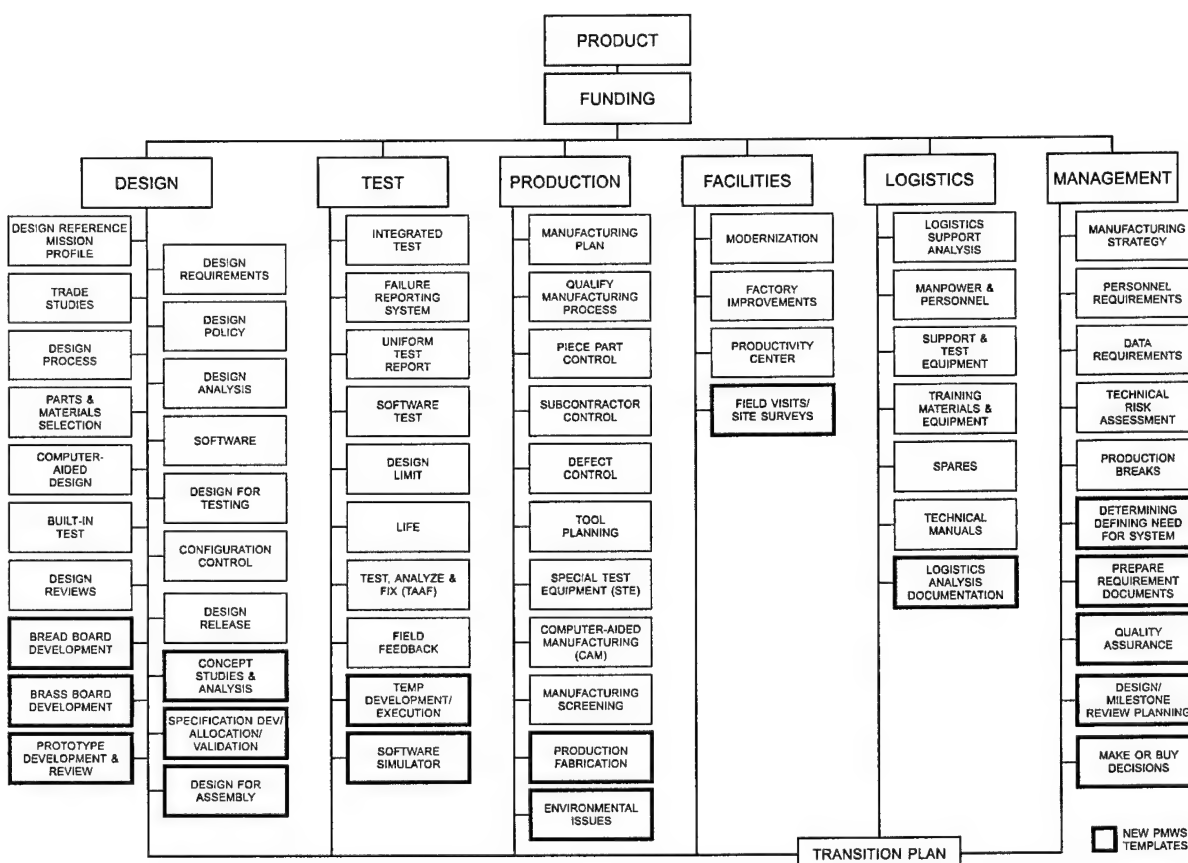
Critical Path Templates and BMP Templates

This survey was structured around and concentrated on the functional areas of design, test, production, facilities, logistics, and management as presented in the Department of Defense 4245.7-M, *Transition from Development to Production* document. This publication defines the proper tools—or templates—that constitute the critical path for a successful material acquisition program. It describes techniques for improving the acquisition

process by addressing it as an *industrial* process that focuses on the product's design, test, and production phases which are interrelated and interdependent disciplines.

The BMP program has continued to build on this knowledge base by developing 17 new templates that complement the existing DOD 4245.7-M templates. These BMP templates address new or emerging technologies and processes.

“CRITICAL PATH TEMPLATES FOR TRANSITION FROM DEVELOPMENT TO PRODUCTION”



Appendix D

BMPnet and the Program Manager's WorkStation

The BMPnet, located at the Best Manufacturing Practices Center of Excellence (BMPCOE) in College Park, Maryland, supports several communication features. These features include the Program Manager's WorkStation (**PMWS**), electronic mail and file transfer capabilities, as well as access to Special Interest Groups (SIGs) for specific topic information and communication. The BMPnet can be accessed through the World Wide Web (at <http://www.bmpcoe.org>), through free software that connects directly over the Internet or through a modem. The PMWS software is also available on CD-ROM.

PMWS provides users with timely acquisition and engineering information through a series of interrelated software environments and knowledge-based packages. The main components of PMWS are KnowHow, SpecRite, the Technical Risk Identification and Mitigation System (TRIMS), and the BMP Database.

KnowHow is an intelligent, automated program that provides rapid access to information through an intelligent search capability. Information currently available in KnowHow handbooks includes Acquisition Streamlining, Non-Development Items, Value Engineering, NAVSO P-6071 (Best Practices Manual), MIL-STD-2167/2168 and the DoD 5000 series documents. KnowHow cuts document search time by 95%, providing critical, user-specific information in under three minutes.

SpecRite is a performance specification generator based on expert knowledge from all uniformed services. This program guides acquisition person-

nel in creating specifications for their requirements, and is structured for the build/approval process. SpecRite's knowledge-based guidance and assistance structure is modular, flexible, and provides output in MIL-STD 961D format in the form of editable WordPerfect® files.

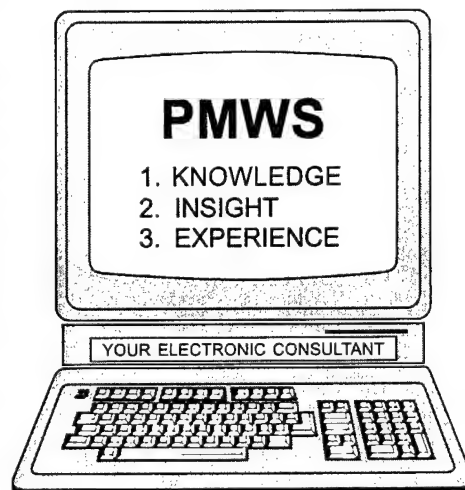
TRIMS, based on DoD 4245.7-M (the transition templates), NAVSO P-6071, and DoD 5000 event-oriented acquisition, helps the user identify and rank a program's high-risk areas. By helping the user conduct a full range of risk assessments through-

out the acquisition process, TRIMS highlights areas where corrective action can be initiated before risks develop into problems. It also helps users track key project documentation from concept through production including goals, responsible personnel, and next action dates for future activities.

The **BMP Database** contains proven best practices from industry, government, and the academic communities. These best practices are in the areas of design, test, production, facilities, management, and logistics. Each practice has been

observed, verified, and documented by a team of government experts during BMP surveys.

Access to the BMPnet through dial-in or on Internet requires a special modem program. This program can be obtained by calling the BMPnet Help Desk at (301) 403-8179 or it can be downloaded from the World Wide Web at <http://www.bmpcoe.org>. To receive a user/e-mail account on the BMPnet, send a request to helpdesk@bmpcoe.org.



Appendix E

Best Manufacturing Practices Satellite Centers

There are currently six Best Manufacturing Practices (BMP) satellite centers that provide representation for and awareness of the BMP program to regional industry, government and academic institutions. The centers also promote the use of BMP with regional Manufacturing Technology Centers. Regional manufacturers can take advantage of the BMP satellite centers to help resolve problems, as the centers host informative, one-day regional workshops that focus on specific technical issues.

Center representatives also conduct BMP lectures at regional colleges and universities; maintain lists of experts who are potential survey team members; provide team member training; identify regional experts for inclusion in the BMPnet SIG e-mail; and train regional personnel in the use of BMP resources such as the BMPnet.

The six BMP satellite centers include:

California

Chris Matzke

BMP Satellite Center Manager
Naval Warfare Assessment Division
Code QA-21, P.O. Box 5000
Corona, CA 91718-5000
(909) 273-4992
FAX: (909) 273-4123
cmatzke@bmpcoe.org

Jack Tamargo

BMP Satellite Center Manager
257 Cottonwood Drive
Vallejo, CA 94591
(707) 642-4267
FAX: (707) 642-4267
jtamargo@bmpcoe.org

District of Columbia

Margaret Cahill

BMP Satellite Center Manager
U.S. Department of Commerce
14th Street & Constitution Avenue, NW
Room 3876 BXA
Washington, DC 20230
(202) 482-8226/3795
FAX: (202) 482-5650
mcahill@bxa.doc.gov

Illinois

Thomas Clark

BMP Satellite Center Manager
Rock Valley College
3301 North Mulford Road
Rockford, IL 61114
(815) 654-5515
FAX: (815) 654-4459
adme3tc@rvcux1.rvc.cc.il.us

Pennsylvania

Sherrie Snyder

BMP Satellite Center Manager
MANTEC, Inc.
P.O. Box 5046
York, PA 17405
(717) 843-5054, ext. 225
FAX: (717) 854-0087
snyderss@mantec.org

Tennessee

Tammy Graham

BMP Satellite Center Manager
Lockheed Martin Energy Systems
P.O. Box 2009, Bldg. 9737
M/S 8091
Oak Ridge, TN 37831-8091
(423) 576-5532
FAX: (423) 574-2000
tgraham@bmpcoe.org

Appendix F

Navy Manufacturing Technology Centers of Excellence

The Navy Manufacturing Sciences and Technology Program established the following Centers of Excellence (COEs) to provide focal points for the development and technology transfer of new manufacturing processes and equipment in a cooperative environment with industry, academia, and Navy centers and laboratories. These COEs are consortium-structured for industry, academia, and government involvement in developing and implementing technologies. Each COE has a designated point of contact listed below with the individual COE information.

Best Manufacturing Practices Center of Excellence

The Best Manufacturing Practices Center of Excellence (BMPCOE) provides a national resource to identify and promote exemplary manufacturing and business practices and to disseminate this information to the U.S. Industrial Base. The BMPCOE was established by the Navy's BMP program, Department of Commerce's National Institute of Standards and Technology, and the University of Maryland at College Park, Maryland. The BMPCOE improves the use of existing technology, promotes the introduction of improved technologies, and provides non-competitive means to address common problems, and has become a significant factor in countering foreign competition.

Point of Contact:
Mr. Ernie Renner
Best Manufacturing Practices Center of Excellence
4321 Hartwick Road
Suite 400
College Park, MD 20740
(301) 403-8100
FAX: (301) 403-8180
ernie@bmpcoe.org

Center of Excellence for Composites Manufacturing Technology

The Center of Excellence for Composites Manufacturing Technology (CECMT) provides a national resource for the development and dissemination of composites manufacturing technology to defense contractors and subcontractors. The CECMT is managed by the GreatLakes Composites Consortium and represents a collaborative effort among industry, academia, and government to develop, evaluate, demonstrate, and test composites manufacturing technologies. The technical work is problem-driven to reflect current and future Navy needs in the composites industrial community.

Point of Contact:
Dr. Roger Fountain
Center of Excellence for Composites Manufacturing Technology
103 Trade Zone Drive
Suite 26C
West Columbia, SC 29170
(803) 822-3705
FAX: (803) 822-3730
frglcc@aol.com

Electronics Manufacturing Productivity Facility

The Electronics Manufacturing Productivity Facility (EMPF) identifies, develops, and transfers innovative electronics manufacturing processes to domestic firms in support of the manufacture of affordable military systems. The EMPF operates as a consortium comprised of industry, university, and government participants, led by the American Competitiveness Institute under a CRADA with the Navy.

Point of Contact:
Mr. Alan Criswell
Electronics Manufacturing Productivity Facility
Plymouth Executive Campus
Bldg 630, Suite 100
630 West Germantown Pike
Plymouth Meeting, PA 19462
(610) 832-8800
FAX: (610) 832-8810
<http://www.engriupui.edu/empf/>

National Center for Excellence in Metalworking Technology

The National Center for Excellence in Metalworking Technology (NCEMT) provides a national center for the development, dissemination, and implementation of advanced technologies for metalworking products and processes. The NCEMT, operated by Concurrent Technologies Corporation, helps the Navy and defense contractors improve

manufacturing productivity and part reliability through development, deployment, training, and education for advanced metalworking technologies.

Point of Contact:

Mr. Richard Henry

National Center for Excellence in Metalworking
Technology

1450 Scalp Avenue

Johnstown, PA 15904-3374

(814) 269-2532

FAX: (814) 269-2799

henry@ctc.com

Navy Joining Center

The Navy Joining Center (NJC) is operated by the Edison Welding Institute and provides a national resource for the development of materials joining expertise and the deployment of emerging manufacturing technologies to Navy contractors, subcontractors, and other activities. The NJC works with the Navy to determine and evaluate joining technology requirements and conduct technology development and deployment projects to address these issues.

Point of Contact:

Mr. David P. Edmonds

Navy Joining Center

1100 Kinnear Road

Columbus, OH 43212-1161

(614) 487-5825

FAX: (614) 486-9528

dave_edmonds@ewi.org

Energetics Manufacturing Technology Center

The Energetics Manufacturing Technology Center (EMTC) addresses unique manufacturing processes and problems of the energetics industrial base to ensure the availability of affordable, quality energetics. The focus of the EMTC is on process technology with a goal of reducing manufacturing costs while improving product quality and reliability. The COE also maintains a goal of development and implementation of environmentally benign energetics manufacturing processes.

Point of Contact:

Mr. John Brough

Energetics Manufacturing Technology Center

Indian Head Division

Naval Surface Warfare Center

Indian Head, MD 20640-5035

(301) 743-4417

DSN: 354-4417

FAX: (301) 743-4187

mt@command.nosih.sea06.navy.mil

Manufacturing Science and Advanced Materials Processing Institute

The Manufacturing Science and Advanced Materials Processing Institute (MS&I) is comprised of three centers including the National Center for Advanced Drivetrain Technologies (NCADT), The Surface Engineering Manufacturing Technology Center (SEMTC), and the Laser Applications Research Center (LaserARC). These centers are located at The Pennsylvania State University's Applied Research Laboratory. Each center is highlighted below.

Point of Contact for MS&I:

Mr. Henry Watson

Manufacturing Science and Advanced Materials
Processing Institute

ARL Penn State

P.O. Box 30

State College, PA 16804-0030

(814) 865-6345

FAX: (814) 863-1183

hew2@psu.edu

- **National Center for Advanced Drivetrain Technologies**

The NCADT supports DoD by strengthening, revitalizing, and enhancing the technological capabilities of the U.S. gear and transmission industry. It provides a site for neutral testing to verify accuracy and performance of gear and transmission components.

Point of Contact for NCADT:

Dr. Suren Rao

NCADT/Drivetrain Center

ARL Penn State

P.O. Box 30

State College, PA 16804-0030

(814) 865-3537

FAX: (814) 863-6185

http://www.arl.psu.edu/drivetrain_center.html

- **Surface Engineering Manufacturing Technology Center**

The SEMTC enables technology development in surface engineering—the systematic and rational modification of material surfaces to provide desirable material characteristics and performance. This can be implemented for complex optical, electrical, chemical, and mechanical functions or products that affect the cost, operation, maintainability, and reliability of weapon systems.

Point of Contact for SEMTC:
Dr. Maurice F. Amateau
SEMTC/Surface Engineering Center
P.O. Box 30
State College, PA 16804-0030
(814) 863-4214
FAX: (814) 863-0006
http://www.arl.psu.edu/divisions/arl_org.html

- **Laser Applications Research Center**

The LaserARC is established to expand the technical capabilities of DOD by providing access to high-power industrial lasers for advanced material processing applications. LaserARC offers basic and applied research in laser-material interaction, process development, sensor technologies, and corresponding demonstrations of developed applications.

Point of Contact for LaserARC:
Mr. Paul Denney
Laser Center
ARL Penn State
P.O. Box 30
State College, PA 16804-0030
(814) 865-2934
FAX: (814) 863-1183
http://www.arl.psu.edu/divisions/arl_org.html

Gulf Coast Region Maritime Technology Center

The Gulf Coast Region Maritime Technology Center (GCRMTC) is located at the University of New Orleans and will focus primarily on product developments in support of the U.S. shipbuilding industry. A sister site at Lamar University in Orange, Texas will focus on process improvements.

Point of Contact:
Dr. John Crisp
Gulf Coast Region Maritime Technology Center
University of New Orleans
Room N-212
New Orleans, LA 70148
(504) 286-3871
FAX: (504) 286-3898

Appendix G

Completed Surveys

As of this publication, 88 surveys have been conducted by BMP at the companies listed below. Copies of older survey reports may be obtained through DTIC or by accessing the BMPnet. Requests for copies of recent survey reports or inquiries regarding the BMPnet may be directed to:

Best Manufacturing Practices Program
 4321 Hartwick Rd., Suite 400
 College Park, MD 20740
 Attn: Mr. Ernie Renner, Director
 Telephone: 1-800-789-4267
 FAX: (301) 403-8180
 ernie@bmpcoe.org

1985	Litton Guidance & Control Systems Division - Woodland Hills, CA
1986	Honeywell, Incorporated Undersea Systems Division - Hopkins, MN (Alliant TechSystems, Inc.) Texas Instruments Defense Systems & Electronics Group - Lewisville, TX General Dynamics Pomona Division - Pomona, CA Harris Corporation Government Support Systems Division - Syosset, NY IBM Corporation Federal Systems Division - Owego, NY Control Data Corporation Government Systems Division - Minneapolis, MN
1987	Hughes Aircraft Company Radar Systems Group - Los Angeles, CA ITT Avionics Division - Clifton, NJ Rockwell International Corporation Collins Defense Communications - Cedar Rapids, IA UNISYS Computer Systems Division - St. Paul, MN (Paramax)
1988	Motorola Government Electronics Group - Scottsdale, AZ General Dynamics Fort Worth Division - Fort Worth, TX Texas Instruments Defense Systems & Electronics Group - Dallas, TX Hughes Aircraft Company Missile Systems Group - Tucson, AZ Bell Helicopter Textron, Inc. - Fort Worth, TX Litton Data Systems Division - Van Nuys, CA GTE C ³ Systems Sector - Needham Heights, MA
1989	McDonnell-Douglas Corporation McDonnell Aircraft Company - St. Louis, MO Northrop Corporation Aircraft Division - Hawthorne, CA Litton Applied Technology Division - San Jose, CA Litton Amecom Division - College Park, MD Standard Industries - LaMirada, CA Engineered Circuit Research, Incorporated - Milpitas, CA Teledyne Industries Incorporated Electronics Division - Newbury Park, CA Lockheed Aeronautical Systems Company - Marietta, GA Lockheed Corporation Missile Systems Division - Sunnyvale, CA Westinghouse Electronic Systems Group - Baltimore, MD General Electric Naval & Drive Turbine Systems - Fitchburg, MA Rockwell International Corporation Autonetics Electronics Systems - Anaheim, CA TRICOR Systems, Incorporated - Elgin, IL
1990	Hughes Aircraft Company Ground Systems Group - Fullerton, CA TRW Military Electronics and Avionics Division - San Diego, CA MechTronics of Arizona, Inc. - Phoenix, AZ Boeing Aerospace & Electronics - Corinth, TX Technology Matrix Consortium - Traverse City, MI Textron Lycoming - Stratford, CT

1991	<i>Resurvey of Litton Guidance & Control Systems Division</i> - Woodland Hills, CA Norden Systems, Inc. - Norwalk, CT Naval Avionics Center - Indianapolis, IN United Electric Controls - Watertown, MA Kurt Manufacturing Co. - Minneapolis, MN MagneTek Defense Systems - Anaheim, CA Raytheon Missile Systems Division - Andover, MA AT&T Federal Systems Advanced Technologies and AT&T Bell Laboratories - Greensboro, NC and Whippany, NJ <i>Resurvey of Texas Instruments Defense Systems & Electronics Group</i> - Lewisville, TX
1992	Tandem Computers - Cupertino, CA Charleston Naval Shipyard - Charleston, SC Conax Florida Corporation - St. Petersburg, FL Texas Instruments Semiconductor Group Military Products - Midland, TX Hewlett-Packard Palo Alto Fabrication Center - Palo Alto, CA Watervliet U.S. Army Arsenal - Watervliet, NY Digital Equipment Company Enclosures Business - Westfield, MA and Maynard, MA Computing Devices International - Minneapolis, MN <i>(Resurvey of Control Data Corporation Government Systems Division)</i> Naval Aviation Depot Naval Air Station - Pensacola, FL
1993	NASA Marshall Space Flight Center - Huntsville, AL Naval Aviation Depot Naval Air Station - Jacksonville, FL Department of Energy Oak Ridge Facilities (Operated by Martin Marietta Energy Systems, Inc.) - Oak Ridge, TN McDonnell Douglas Aerospace - Huntington Beach, CA Crane Division Naval Surface Warfare Center - Crane, IN and Louisville, KY Philadelphia Naval Shipyard - Philadelphia, PA R. J. Reynolds Tobacco Company - Winston-Salem, NC Crystal Gateway Marriott Hotel - Arlington, VA Hamilton Standard Electronic Manufacturing Facility - Farmington, CT Alpha Industries, Inc. - Methuen, MA
1994	Harris Semiconductor - Melbourne, FL United Defense, L.P. Ground Systems Division - San Jose, CA Naval Undersea Warfare Center Division Keyport - Keyport, WA Mason & Hanger - Silas Mason Co., Inc. - Middletown, IA Kaiser Electronics - San Jose, CA U.S. Army Combat Systems Test Activity - Aberdeen, MD Stafford County Public Schools - Stafford County, VA
1995	Sandia National Laboratories - Albuquerque, NM Rockwell Defense Electronics Collins Avionics & Communications Division - Cedar Rapids, IA <i>(Resurvey of Rockwell International Corporation Collins Defense Communications)</i> Lockheed Martin Electronics & Missiles - Orlando, FL McDonnell Douglas Aerospace (St. Louis) - St. Louis, MO <i>(Resurvey of McDonnell-Douglas Corporation McDonnell Aircraft Company)</i> Dayton Parts, Inc. - Harrisburg, PA Wainwright Industries - St. Peters, MO Lockheed Martin Tactical Aircraft Systems - Fort Worth, TX <i>(Resurvey of General Dynamics Fort Worth Division)</i> Lockheed Martin Government Electronic Systems - Moorestown, NJ Sacramento Manufacturing and Services Division - Sacramento, CA JLG Industries, Inc. - McConnellsburg, PA
1996	City of Chattanooga - Chattanooga, TN Mason & Hanger Corporation - Pantex Plant - Amarillo, TX Nascote Industries, Inc. - Nashville, IL Weirton Steel Corporation - Weirton, WV NASA Kennedy Space Center - Cape Canaveral, FL

1997

Headquarters, U.S. Army Industrial Operations Command - Rock Island, IL
